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Two New Species of the Genus *Bavayia* (Reptilia: Squamata: Diplodactylidae) from New Caledonia, Southwest Pacific[1]

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ABSTRACT: Two new species of the diplodactylid gecko *Bavayia* are described from restricted areas within the main island of New Caledonia. Both species are characterized by small size, a single row of preanal pores, and distinctive dorsal color patterns. One species is known only from the endangered sclerophyll forest of the drier west coast of New Caledonia, where it was collected in the largest remaining patch of such habitat on the Pindaï Peninsula. The second species occupies the maquis and adjacent midelevation humid forest habitats in the vicinity of Mé Adéo in south-central New Caledonia. Although relationships within the genus *Bavayia* remain unknown, the two new species appear to be closely related to one another.

BAVAYIA IS ONE OF THREE genera of carphodactyline geckos that are endemic to the New Caledonian region. Seven species are currently recognized in the genus (Bauer 1990). Three of these, *B. crassicollis* Roux, *B. cyclura* (Günther), and *B. sauvagii* (Boulenger), are relatively widely distributed, with populations on the Isle of Pines (Bauer and Sadlier 1994) and the Loyalty Islands (Sadlier and Bauer 1997*a*), as well as on the New Caledonian mainland and most smaller satellite islands in the group (Bauer and Vindum 1990). The remaining members of the genus include two species occurring only at middle to high elevations in the northern portion of the main island (*B. ornata* Roux and *B. validiclavis* Sadlier), one more widely distributed upland form, *B. montana* Roux, and *B. septuiclavis* Sadlier, limited to the southern portion of the main island. The two most widespread species, *B. cyclura* and *B. sauvagii*, are both probably composites of several morphologically similar, cryptic sibling species. Recent field investigations on the New Caledonian mainland have revealed the presence of two additional species of *Bavayia*. Both are small, distinctively patterned, and apparently restricted in distribution.

MATERIALS AND METHODS

Specimens from the collections of the Australian Museum (AMS), California Academy of Sciences (CAS), and Muséum National d'Histoire Naturelle, Paris (MNHN), were examined under a dissecting microscope (Nikon SMZ-10) and measurements were taken with digital calipers (Brown and Sharpe Digit-cal Plus). Radiographs were prepared using a cabinet x-ray system (Faxitron) with exposures of 40 sec at 40 kV. The following measurements were recorded for each specimen: snout-vent length (SVL); forearm length from elbow to level of the base of the third metacarpal (FA); forelimb length from limb insertion to level of the base of the third metacarpal (FOL); crus length from knee to level of the base of the third metatarsal (TBL); hindlimb length from limb insertion to position of the base of the third metatarsal

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(HIL); tail length (TL); tail width at base (TWB); tail width at first postpygal vertebra (TWP); axilla-groin length (AG); head length from posterior edge of mandible to snout tip (HL); maximal head width (HW); maximal head depth (HD); eye diameter (ED); distance from posterior border of orbit to anterior margin of ear (EE); and distance from anterior border of orbit to tip of snout (ES). Subdigital lamellae (SDL) were counted from the proximalmost enlarged setae-bearing lamellae to the distal tip of the digits. In the case of digit I, the paired apical plates were included in lamellar counts.

SYSTEMATICS

Bavayia exsuccida Bauer, Whitaker & Sadlier, n. sp.

Figures 1*A–B*, 2*A–D*

TYPE MATERIAL: Holotype: CAS 202787, adult male, Pindaï forest, Pindaï Peninsula, Province Nord (20 m elevation), New Caledonia, 21° 19′ 57″ S, 164° 58′ 14″ E, collected by A. M. Bauer, R. A. Sadlier, and S. Smith, 10 February 1997. Paratypes (all from same locality as holotype): AMS R 147794, 147796, collected by H. Jourdan, 22 February 1995; AMS R 149362–3, collected by A. H. Whitaker, 9 June 1996; AMS R 150657–9, CAS 202759–61, MNHN 1997.3277, collected by A. M. Bauer, R. A. Sadlier, and S. Smith, 8 February 1997; AMS R 150667–9, CAS 202786, 202788–9, MNHN 1997.3276, collected by A. M. Bauer, R. A. Sadlier, and S. Smith, 10 February 1997.

ETYMOLOGY: The species name *exsuccida* is the feminine form of the adjectival form of the Latin word *exsuccus* (or *exuccus*) meaning juiceless or sapless. It refers to the habitat of the species in the sclerophyll forest patches of western coastal New Caledonia. These forests occur on the dry west coast of New Caledonia and are often referred to as "dry forests."

DIAGNOSIS: A small species of *Bavayia* (maximum SVL 47.2 mm) distinguished from its congeners by the following combination of characteristics: claw of digit I (manus and pes) positioned asymmetrically between a larger medial and smaller lateral portion of a cleft apical scansor; preanal pores 16–23, in a single row; first supralabial excluded from, or in narrow contact with, nostril; dorsal pattern with a prominent light "V" on the nape and transverse bars or chevrons on remainder of trunk, venter without bright pigmentation.

DESCRIPTION (based on holotype, an adult male): SVL 39.00 mm; body short (AG = 40% SVL), robust, weakly depressed. Head oblong, large (HL = 27% SVL), relatively wide (HW = 73% HL), depressed (HD = 41% HL), distinct from neck; interorbital/frontal region somewhat depressed, canthus weakly developed; snout relatively short (ES = 40% HL), longer than eye diameter (ED = 26% HL). Scales on snout approximately twice diameter of those on occipital region. Eye moderate, approximately one-fourth head length; pupil oval, crenelated; posterior supraciliary scales elongate, pointed. Ear opening approximately twice as high as wide, canted posterodorsally to anteroventrally; eye to ear distance greater than the diameter of eyes (EE = 121% ED). Rostral rectangular, broader than high, divided by a partial groove running downward for a distance of 40% of the rostral height, contacted posteriorly by three internasals and two slightly enlarged supranasals, contacted posteroventrally by first supralabial. Nostrils oval and anterolaterally oriented, surrounded by three nasals, one supranasal, and the rostral, very narrowly excluded from contact with first supralabial; ventralmost nasal crescentic and in moderate contact with first supralabial (Figure 2*A*). Three similarly sized internasal scales between supranasals. Mental triangular, somewhat wider than deep; a single enlarged, pentagonal, median postmental in narrow contact with apex of mental, separating first infralabials from one another; first infralabials each in contact posteriorly with median postmental and two smaller chin shields (Figure 2*B*). First two rows of chin shields larger than remaining throat scales. Eight enlarged supralabial scales, of which fifth through eighth are be-

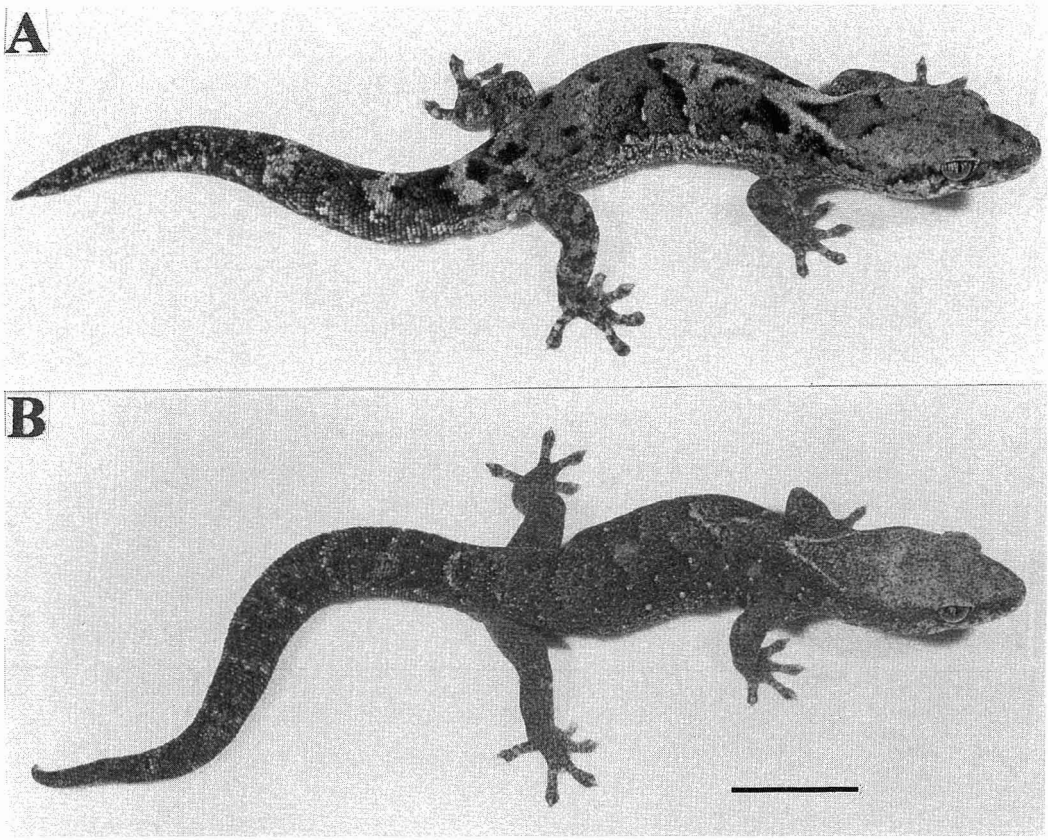

FIGURE 1. Living specimens of *Bavayia exsuccida* illustrating *(A)* the more common bold pattern (AMS R 149363) and *(B)* the paler pattern (AMS R 149362), in which dorsal contrast is reduced. Note the prominent light "V" on the nape in both specimens. Scale bar = 10 mm.

neath eye; eight infralabial scales; 31 interorbital scale rows at midpoint of orbit.

Dorsal scales small, homogeneous, slightly conical, granular; ventral scales slightly larger than dorsals, subimbricate, enlarged posteriorly on the body. Posterior abdominal scales rounded, mid-abdominal scales elongate, with protracted posterior margins. Approximately 130 scale rows around midbody. Scales of the limbs not differing from dorsals. Scales on palms and soles smooth, flattened. Preanal pores in a single row, 10 pores on either side of a single poreless scale. Forelimbs and hindlimbs relatively short (32% and 42% of SVL, respectively), axillary pockets moderately well developed. Digits short, all bearing claws, those on digit I of both manus and pes greatly reduced and partially sheathed (Figure 2*C–D*); relative length of digits of manus: IV $\simeq$ III > II $\simeq$ VI > I, and of pes: IV $\simeq$ V > III > II > I; digits weakly webbed; digits III and IV of pes tightly bound along length of elongate metatarsals. Subdigital lamellae typically paired, except variably single at base of digits and on digit I. Distalmost lamella of digits II–V, manus, and pes undivided. Apical plates of digit I, manus, and pes asymmetrical, with claw positioned between a larger medial and smaller lateral plate. Lamellar counts from right side of holotype: 5-9-9-11-9 manus and 5-10-11-10-10 pes.

Tail (original with regenerated tip of 16.8 mm) approximately 82% of SVL, stout,

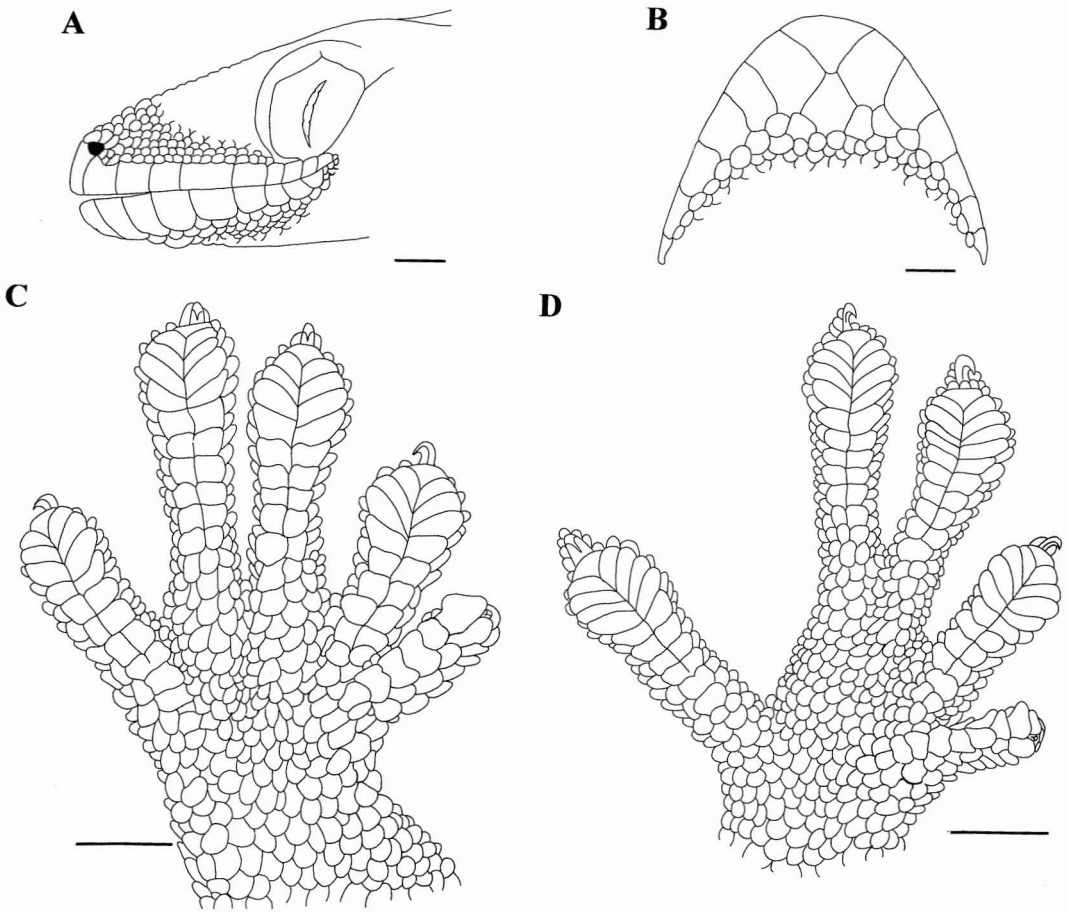

FIGURE 2. Scalation features of the holotype of *Bavayia exsuccida* (CAS 202787). *A.* Lateral view of head illustrating circumnarial and labial scalation. *B.* Ventral view of chin illustrating enlarged postmental and separation of first infralabials from one another. *C.* Ventral view of right manus showing offset reduced claw of digit I and lamellar arrangements of toes. *D.* Ventral view of right pes showing offset reduced claw of digit I and lamellar arrangements of toes. Scale bars = 1 mm.

roughly oval in cross section; tail base at cloacal spurs distinctly swollen. Caudal scales small, flat, rectangular, arranged in regular rows. Surface of tail weakly segmented, caudal scale rows forming whorls, each whorl 8–9 dorsal scale rows and 4–5 ventral scale rows long; midventral caudal scales not enlarged. Cloacal spurs consisting of two radiating sets of conical scales directed posterodorsally and borne on a raised mound adjacent to the cloaca; larger, medial set with three scales, smaller, lateral set with two scales. No grossly visible adhesive tail pad, although setal fields at the tail tip are visible microscopically.

Color in preservative: Dorsum light brown with darker flecks on individual scales. Dorsum of head beige to cream, lighter on parietal region. Dark brown canthal stripes extend from internarial region across loreals to anterior margin of eye and under eye to posterior one-third of orbit. Scattered dark brown marks across frontal, supraorbital, and parietal regions. Labial scales with cream centers and dark brown margins. An irregular dark brown band, approximately

three scale rows wide across occiput. Prominent cream "V" on nape with apex between shoulders, bordered all around by dark scales forming a wedge between arms of "V" and well-defined, thick longitudinal bands lateral to vertebral axis. These continue anteriorly as less well-defined stripes passing ventrolateral to the cream parietal crown and reaching posterior border of orbit. Dorsum posterior to axilla with alternating wide saddles of base color and narrower dark, incomplete bands (three between axilla and groin). Another set of dark transverse markings on sacrum and base of postpygal portion of tail, defining a bold, pale chevron. Flanks with an irregular sinuous, dark brown stripe incorporating lateral edges of dorsal band. Flanks with two longitudinal series of clusters of white scales (2–5 scales per cluster), ventral series more prominent than dorsal. Venter mottled beige, most scales with a darker brown central mark, darker beneath throat, limbs, and hemipenial bulge. Limbs marbled with more-or-less continuous dark stripe from limb insertion, across posterior margin of thigh and onto postaxial margin of shank. Joints in manus and pes cream. Original tail with alternating dark brown and cream markings. Regenerated portion of tail darker brown with irregular longitudinally oriented darker dashes. Tail venter mottled mid-brown and cream.

VARIATION (based on entire type series): Labial scale numbers (supralabials/infralabials) variable: 7/8 (17%), 8/8 (33%), 8/9 (6%), 9/7 (6%), 9/8 (22%), 9/9 (17%). Extent of infralabial separation by enlarged median postmental scale variable, in two specimens there was narrow contact anteriorly between the first infralabials. Each first infralabial contacted by enlarged median postmental scale and either one or two slightly enlarged chin shields; left and right sides relatively symmetrical in most cases, three specimens with two enlarged chin shields on one side and one on other. Median postmental fragmented in one specimen. First supralabial narrowly contacting nostril in most specimens, bilaterally ($n = 3$) or unilaterally ($n = 1$) excluded from nostril in others.

Preanal pores 16–23 (mean = 20.5, SD = 1.9, $n = 10$) arranged in chevrons that are continuous (two specimens), divided by a single poreless apical scale (seven specimens), or divided by a gap of five scales (one specimen). Pores absent in all female specimens. Cloacal spurs of males with a single row of four enlarged conical scales (one specimen), or with two rows of two medial and two lateral scales ($n = 2$), three medial and three lateral scales ($n = 5$), or two medial and three lateral or three medial and two lateral scales (one specimen each). Cloacal spurs of females much reduced, consisting of a single row of one ($n = 1$), two ($n = 3$), or three ($n = 4$) enlarged, rounded scales. Midbody scale rows from 130 to 135 (mean = 131.8, SD = 2.1, $n = 6$). In specimens with complete original tails ($n = 8$) an adhesive tail pad is grossly visible, incorporating about nine pairs of parallel lamellae at the ventral tail tip.

Mensural and proportional characteristics of paratypes are presented in Table 1; variation in subdigital lamellae number is presented in Table 2.

Coloration highly variable. In several specimens base body color is much paler than in holotype and contrast among elements of the dorsal pattern is much reduced (Figure 1*B*). Darker markings in particular are obscure in some specimens. Although not clearly outlined, the "V"-shaped marking on the nape and shoulders remains the most prominent feature. In these paler specimens the paravertebral dark markings are reduced or absent and the mid- and posterior sections of the dorsum are weakly marked by a series of transverse bands or chevrons equivalent to those seen in the holotype.

OSTEOLOGY: The holotype possesses 26 presacral, 2 sacral, and 13 caudal vertebrae (5 pygal, 8 postpygal anterior to regenerate). Among the paratypes the only vertebral variation was in postpygal vertebral number, which ranges from 23 to 25 in the six specimens with original tails. The phalangeal formulas of the manus and pes are unreduced: 2-3-4-5-3 manus and 2-3-4-5-4 pes. Premaxillary tooth loci 11 in all except one specimen,

TABLE 1

SUMMARY OF MENSURAL AND PROPORTIONAL MEASUREMENTS OF *Bavayia exsuccida* AND *B. pulchella* (SEE *Materials and Methods* FOR ABBREVIATIONS)

	Bavayia exsuccida				*Bavayia pulchella*			
PARAMETER	MINIMUM	MAXIMUM	MEAN	SD	MINIMUM	MAXIMUM	MEAN	SD
Mensural values								
SVL	32.97	47.16	39.32	3.68	37.27	49.32	43.52	2.88
TL*	35.26	41.11	37.81	2.48	30.18	38.70	34.49	2.42
TW	3.16	5.04	3.95	0.53	3.25	5.60	4.43	0.75
FA	10.37	13.17	11.87	0.83	10.73	14.20	12.60	0.94
TBL	13.04	17.83	15.88	1.19	15.12	19.03	17.44	1.14
AG	12.79	21.65	16.79	2.64	14.55	22.99	18.70	1.69
HL	9.73	13.15	11.07	0.87	10.55	13.28	11.93	0.86
HW	6.02	8.34	7.14	0.61	6.49	8.87	7.82	0.56
HD	3.47	4.98	4.35	0.46	4.05	5.35	4.59	0.30
ED	2.10	2.93	2.45	0.24	2.46	3.28	2.84	0.23
EE	2.48	3.95	3.24	0.44	2.92	3.94	3.36	0.23
ES	3.49	4.44	4.04	0.28	3.80	4.83	4.42	0.25
Proportional values								
TL/SVL	0.87	1.08	0.98	0.08	0.62	0.91	0.80	0.07
FA/SVL	0.27	0.34	0.30	0.02	0.25	0.32	0.29	0.02
TBL/SVL	0.34	0.48	0.43	0.04	0.35	0.45	0.40	0.03
AG/SVL	0.35	0.49	0.43	0.04	0.39	0.47	0.43	0.02
HL/SVL	0.24	0.34	0.28	0.02	0.24	0.32	0.27	0.02
HW/HL	0.56	0.79	0.65	0.06	0.55	0.73	0.66	0.05
HD/HL	0.32	0.47	0.39	0.04	0.33	0.46	0.39	0.03
ED/HL	0.18	0.26	0.22	0.02	0.21	0.27	0.24	0.02
EE/HL	0.22	0.37	0.29	0.04	0.24	0.32	0.28	0.02
ES/HL	0.30	0.43	0.37	0.03	0.33	0.40	0.37	0.02

* Includes data from regenerated as well as original tails.

which has 13. Maxillary teeth (unilateral counts) 24–34 (mean = 28.8, SD = 2.3, n = 15), dentary teeth (unilateral counts) 33–37 (mean = 35.1, SD = 1.2, n = 10). A single pair of crescentic cloacal bones is present in all males and absent in females.

DISTRIBUTION, HABITAT, AND NATURAL HISTORY: *Bavayia exsuccida* appears to be restricted to sclerophyll forest habitats and has thus far been collected only at the largest remaining patch of this endangered vegetation type, on the Pindaï Peninsula (Figure 3). The low-canopied (<15 m) sclerophyll forests of New Caledonia are dominated by *Acacia spirorbis* Labillardiére and support a total of 379 native phanerogam species (Jaffré et al. 1993). The herpetofauna of the Pindaï forest is relatively depauperate. In addition to the new species, *Caledoniscincus austrocaledonicus* (Bavay), *Lioscincus nigrofasciolatum* (Peters), *Nannoscincus* cf. *greeri* Sadlier, *Rhacodactylus trachyrhynchus* Bocage, *Eurydactylodes vieillardi* (Bavay), and *Bavayia cyclura* have also been collected at the site (Bauer 1995; H. Jourdan, R. A. Sadlier, and A. M. Bauer, unpubl. data). *Bavayia cyclura* is particularly abundant and at this site appears to prefer somewhat larger perches and larger trees than *B. exsuccida.*

Most of the types were collected by hand at night while active on distal branches and twigs. *Bavayia exsuccida* is relatively fast-moving and agile, and some specimens attempted to escape by climbing into denser foliage or by dropping to the ground. Two specimens were captured on sticky traps set to sample arboreal herpetofauna.

Two eggs were present in each of two of the nine adult females examined (AMS 147794, AMS 150669). Although collected in different years, both gravid specimens were

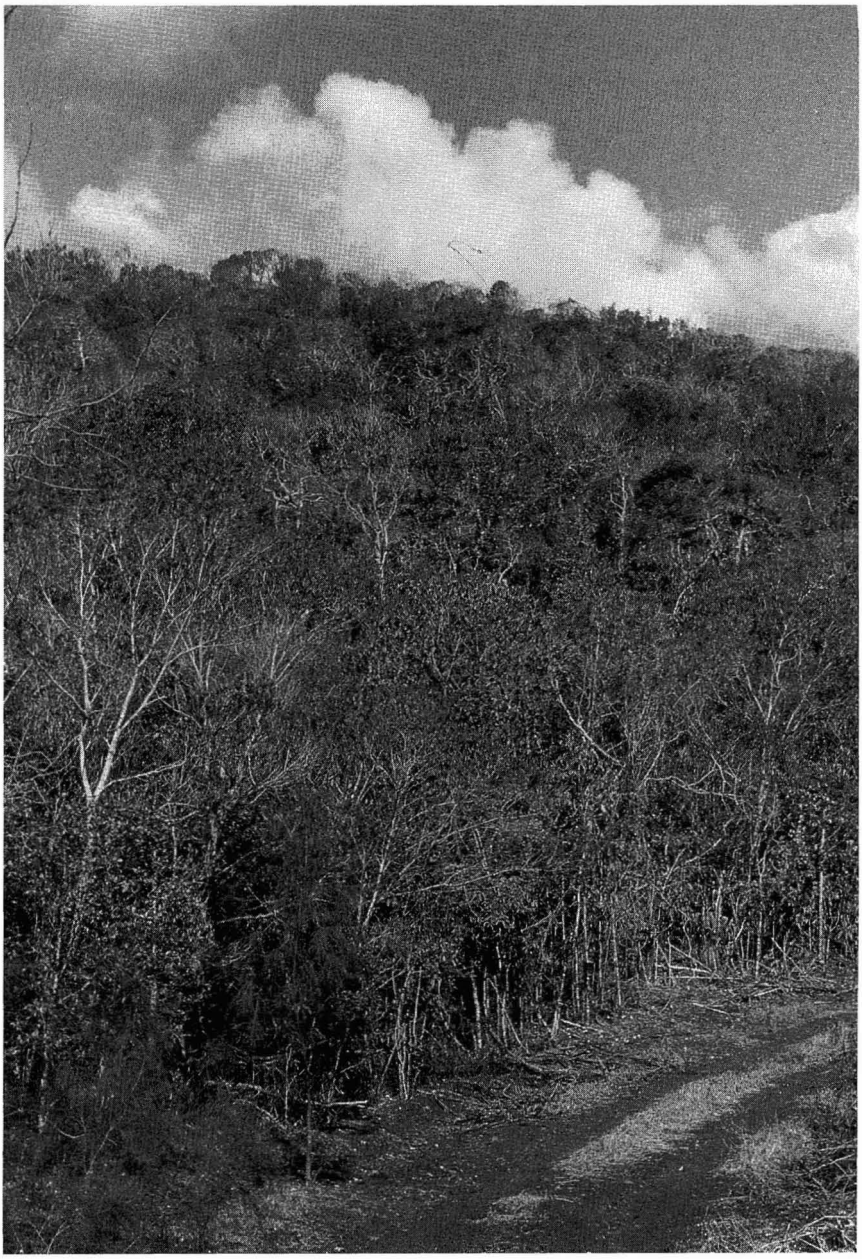

FIGURE 3. Sclerophyll forest at the type locality of *B. exsuccida* on the Pindaï Peninsula. Specimens were collected by night-spotting along the vehicle track.

collected in February. Trombiculid mites were located on or between the digits of three specimens (AMS 147794, CAS 202759, and CAS 202761), although no more than two mites were located on any individual. A shallow axillary pocket is present in this species, but no mites were observed there.

Stomach contents were examined from

two members of the type series. Both specimens contained spiders and several beetles. In addition, a single specimen each of a dipteran and formicid was also identified.

CONSERVATION STATUS: As far as is known, *Bavayia exsuccida* is limited to the sclerophyll forest of the Pindaï Peninsula. Even if it is found in other sclerophyll forest remnants, the species must be considered vulnerable, because the total area of this habitat type in New Caledonia is only about 100 km^2, and this area remains under threat from development and fire (Bouchet et al. 1995). Within the Pindaï forest, however, the species appears to be locally abundant. Part of the Pindaï sclerophyll forest has been invaded by the stinging ant, *Wasmannia auropunctata* Roger. Although the presence of the ant appears to decrease both lizard diversity and density (Jourdan et al., unpubl. data), *B. exsuccida* is present in at least parts of the affected forest (AMS R 149362–3), although the long-term ability of the gecko to coexist with this ant is uncertain.

Bavayia pulchella Bauer, Whitaker & Sadlier, n. sp.

Figures 4*A–B*, 5*A–D*

TYPE MATERIAL: Holotype: AMS R 149873, adult male, Mé Adéo, Nèoua area, Province Nord (600 m elevation), New Caledonia, 21° 28′ 52″ S, 165° 36′ 51″ E, collected by R. Sadlier and A. H. Whitaker, 25 October 1996. Paratypes: AMS R 149874–8, same data as holotype; AMS R 149860–1, 149917–8, MNHN 1997.3682–3, same locality and collectors as holotype, 24 October 1996; AMS R 149953–4, same locality and collectors as holotype, 1 November 1996; AMS R 149931–9, ranges west of Mé Adéo, Bourail area, Province Sud, New Caledonia, 21° 28′ S, 165° 33′ E, collected by R. A. Sadlier and A. H. Whitaker, 31 October 1996.

ETYMOLOGY: The species name *pulchella*, the Latin diminutive for beautiful, refers to both the small size of this species and the complex and attractive dorsal pattern exhibited by most specimens, including the holotype.

DIAGNOSIS: A small species of *Bavayia* (maximum SVL 49.3 mm) distinguished from its congeners by the following combination of characteristics: claw of digit I positioned asymmetrically between a larger medial and smaller lateral portion of a cleft apical scansor; preanal pores 18–23, in a single row; first supralabial typically in moderate to broad contact with nostril; dorsal pattern with a prominent pale vertebral stripe and two less conspicuous dorsolateral stripes, or patternless.

DESCRIPTION (based on holotype, an adult male): SVL 43.3 mm; body short (AG = 42% SVL), robust, weakly depressed. Head oblong, large (HL = 29% SVL), relatively wide (HW = 58% HL), depressed (HD = 35% HL), distinct from neck; interorbital/frontal region somewhat depressed, parietal region weakly depressed, canthus weakly developed; snout relatively short (ES = 36% HL), longer than eye diameter (ED = 26% HL), preorbital region somewhat inflated. Scales on snout approximately two to three times diameter of those on occipital region. Eye moderate, approximately one-fourth head length; pupil oval, crenelated; posterior supraciliary scales elongate, pointed. Ear opening approximately twice as high as wide, canted posterodorsally to anteroventrally; eye to ear distance approximately equal to diameter of eyes (EE = 100% ED). Rostral rectangular, broader than high, divided by a partial groove running downward for a distance of 50% of the rostral height, contacted posteriorly by one large internasal and two large supranasals, contacted posteroventrally by first supralabial. Nostrils oval, anterolaterally oriented, surrounded by rostral, three (right side) or four (left side) nasals, one supranasal, and the first supralabial; ventralmost, crescentic nasal in broad contact with first supralabial (Figure 5*A*). One large internasal scale between supranasals. Mental subtriangular, approximately as broad as deep; a single enlarged, pentagonal, median postmental in broad contact with apex of mental, separating first infralabials from one another; first infralabials each in contact posteriorly with median postmental

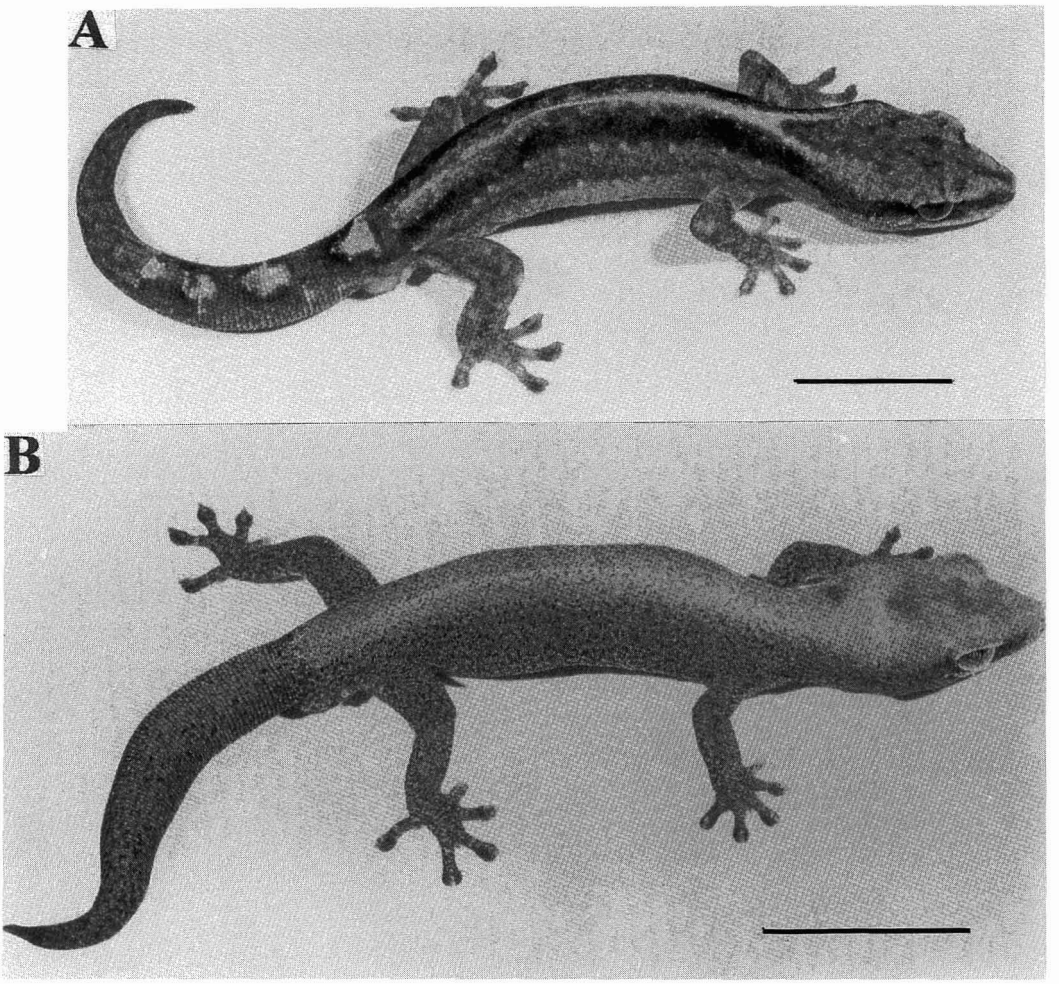

FIGURE 4. Living specimens of *Bavayia pulchella* illustrating *(A)* the more common bold pattern in the holotype (AMS R 149873) and *(B)* the paler pattern (AMS R 149861) in which a dorsal pattern is almost indiscernible. Note the prominent light vertebral stripe and "V" on the nape in the holotype. Scale bars = 10 mm.

and a single enlarged chin shield. First two to three rows of chin shields larger than remaining throat scales. Nine enlarged supralabial scales, of which the sixth through ninth are beneath eye; nine infralabial scales; 39 interorbital scale rows at midpoint of orbit.

Dorsal scales small, homogeneous, slightly conical, granular; ventral scales 2.5–3 times diameter of dorsals, smooth, flattened, subimbricate, enlarged posteriorly on the body. Posterior abdominal scales rounded, midabdominal scales elongate, with protracted posterior margins. Approximately 124 scale rows around midbody. Scales of the limbs not differing from dorsals. Scales on palms and soles smooth, flattened. Preanal pores in a single symmetrical chevron of 21 pores (Figure 5*B*). Forelimbs and hindlimbs relatively short (31% and 35% of SVL, respectively), axillary pocket weakly developed. Digits short, all bearing claws, those on digit I of both manus and pes greatly reduced and partially sheathed (Figure 5*C–D*); relative length of digits of manus: IV $\simeq$ III > II $\simeq$

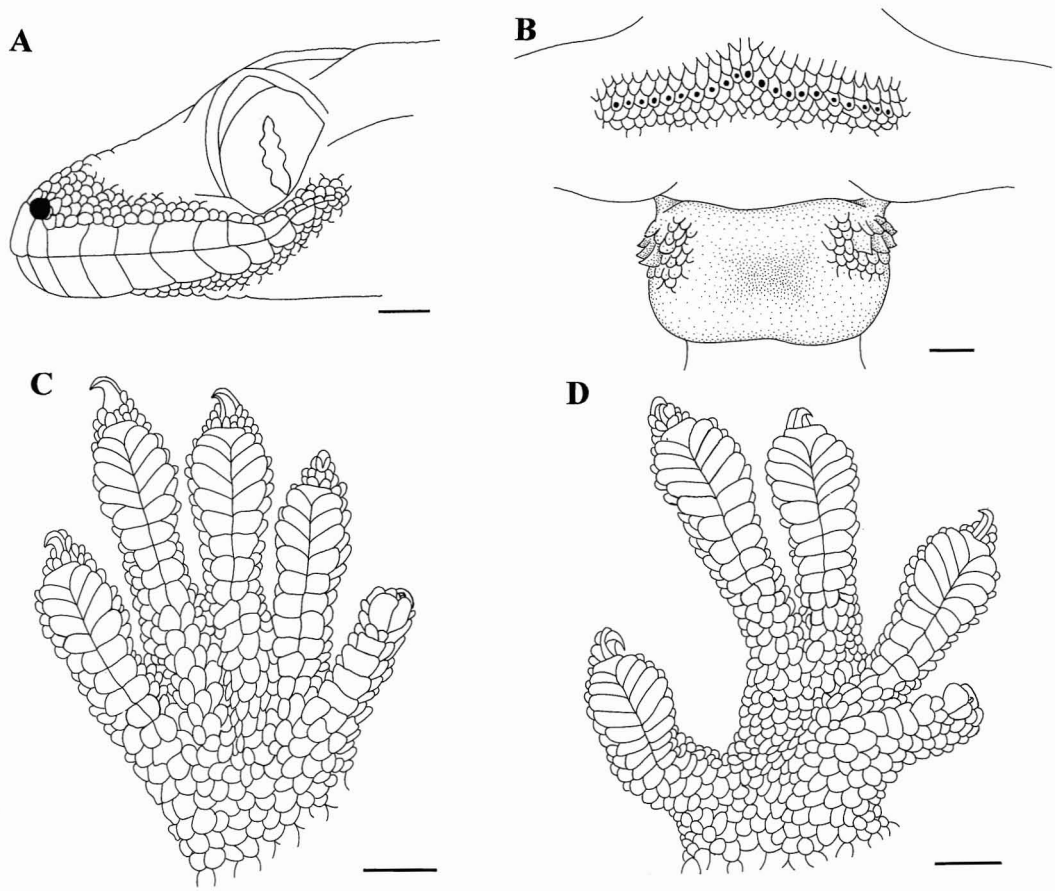

FIGURE 5. Scalation features of the holotype of *Bavayia pulchella* (AMS R 149873). *A.* Lateral view of head illustrating circumnarial and labial scalation. *B.* Ventral view of posterior abdomen and tail base, illustrating the single row of preanal pores, hemipenial bulge, and cloacal spurs. *C.* Ventral view of right manus showing offset reduced claw of digit I and lamellar arrangements of toes. *D.* Ventral view of right pes showing offset reduced claw of digit I and lamellar arrangements of toes. Scale bars = 1 mm.

VI > I, and of pes: IV ≃ V > III > II > I; digits weakly webbed; digits III and IV of pes tightly bound along length of elongate metatarsals. Subdigital lamellae typically paired, except variably single at base of digits and on digit I. Distalmost lamella of digits II–V, manus, and pes undivided. Apical plates of digit I, manus, and pes asymmetrical, with claw positioned between a larger medial and smaller lateral plate. Lamellar counts from right side of holotype: 6-9-10-10-8 manus and 6-10-10-10-9 pes.

Tail (partially regenerated) approximately 83% of SVL, stout, roughly oval in cross section; tail base at cloacal spurs distinctly swollen. Caudal scales small, flat, rectangular, arranged in regular rows. Surface of tail weakly segmented, caudal scale rows forming whorls, each whorl 5–6 dorsal scale rows and 4–5 ventral scale rows long; ventral caudals slightly larger than dorsals, midventral caudal scales not enlarged. Cloacal spurs consisting of a larger, posteromedial set of three to four enlarged conical scales and a set of three smaller, more rounded, anterolateral scales; both sets directed posterodorsally and borne on a raised mound adjacent to the cloaca (Figure 5*B*). No grossly visible adhe-

sive tail pad, although setal fields at the tail tip are visible microscopically.

Color in preservative: Dorsum medium chocolate brown. A prominent cream-colored vertebral stripe with diffuse lateral borders running along dorsum and dividing at nape to form a "V." Arms of "V" continue anteriorly to posterior border of orbit and onto lateral parietal region, finally extending from anterodorsal corner of orbit to dorsal portion of rostral scale, becoming somewhat darker anteriorly. Region beneath this light line, from rostrum to orbit and just posterior to orbit, darker brown than remainder of body. Labial scales mottled light and dark brown. Central portion of dorsum of head cream to light brown, enclosing an irregularly shaped dark brown patch, the borders of which are ill defined except along its anterior and posterior margins. A pair of weakly delimited dorsolateral cream-colored stripes flank vertebral marking and run from angle of jaw, above limb insertions to tail base. Venter mottled light brown, individual scales beige, each with 1–20 darker pigment spots. Scales beneath hemipenial bulge cream colored. Limbs marbled brown with lighter bands across all joints in manus and pes. Sacrum and tail base marked with an equilateral triangle with apex directed posteriorly. Original portion of postpygal tail brown with distinct but irregularly shaped cream middorsal markings. Regenerate streaked with cream and brown scales. Tail venter mottled light brown and cream.

VARIATION (based on entire type series): Labial scale numbers (supralabials/infralabials) variable: 8/8 (4%), 8/9 (4%), 9/7 (4%), 9/8 (26%), 9/9 (17%), 10/8 (13%), 10/9 (30%). In a single specimen the enlarged postmental was absent and the first infralabials were in broad contact with one another; in all other specimens, infralabial separation was maintained. Each first infralabial contacted by enlarged median postmental scale and either one or two enlarged chin shields; in four cases there was asymmetry in this regard, but in all others only a single chin shield on each side was contacted. There are typically three nasals plus a supranasal bordering the nostril, but in four cases there were four nasals on each side and in the holotype the number of nasals was bilaterally asymmetrical. The first supralabial makes moderate to broad contact with the nostril in most specimens but was excluded by a small supernumerary nasal granule in a single specimen. Internasals numbered 1 (22%), 2 (26%), or 3 (52%). In most cases of multiple internasals one was large and the remainder were very small.

Preanal pores 18–23 (mean = 20.4, SD = 1.8, $n = 10$) arranged in chevrons that are continuous (four specimens) or divided by a single poreless apical scale (six specimens). Pores absent in all female specimens. Cloacal spurs of males with 2–4 enlarged conical scales in a single row (mode = 3); anterolateral row of small, rounded scales absent or much reduced in most specimens. In females the cloacal spurs are much reduced and consist of a single row of two ($n = 4$) or three ($n = 8$) somewhat enlarged, rounded scales. In a single specimen there are no enlarged cloacal spur scales. The number of midbody scale rows ranges from 121 to 124 (mean = 122.5, SD = 1.4, $n = 6$). No specimens possess complete original tail, although elongate regenerates are present in numerous specimens. Mensural and proportional characteristics of paratypes are presented in Table 1; variation in subdigital lamellae number is presented in Table 2.

TABLE 2

SUMMARY OF SUBDIGITAL LAMELLAE COUNTS FOR THE TYPE SERIES OF *Bavayia exsuccida* AND *B. pulchella*

	Bavayia exsuccida			*Bavayia pulchella*		
CHARACTER	RANGE	MEAN	SD	RANGE	MEAN	SD
Manus I	4–5	4.26	0.45	4–6	4.30	0.56
Manus II	7–10	8.68	0.75	9–10	9.26	0.45
Manus III	8–12	9.42	1.00	9–12	10.65	0.78
Manus IV	9–13	10.37	1.01	8–12	10.74	0.96
Manus V	7–10	8.84	0.83	8–11	9.39	0.78
Pes I	4–9	4.79	1.18	3–6	4.52	0.73
Pes II	8–11	9.74	0.81	9–11	9.65	0.57
Pes III	9–11	10.26	0.73	10–12	10.61	0.66
Pes IV	9–13	10.74	0.87	10–13	11.00	0.74
Pes V	8–10	9.16	0.60	8–12	10.00	1.68

Coloration highly variable. In several specimens the general body pattern is similar to that of the holotype, but the midvertebral stripe is divided by a complete or incomplete dark brown stripe. Dark bordering stripes may also flank the dorsolateral cream stripes, or these cream stripes may be incomplete and represented by a longitudinal series of whitish spots. In other specimens a series of small white spots is present on the lateral surface anterior to the axilla. Three specimens have a speckled pale brown base body color with only vague indications of paler dorsal and lateral stripes, and in five specimens there is effectively no dorsal pattern discernible on a uniformly pale or dark brown base color (Figure 5*B*). Other variations include the shape of the sacral marking, which may be oval or chevron-shaped as opposed to triangular, as in the holotype, and the presence of diffuse whitish spots on the ventral surface of the regenerated tails in a number of the paratypes.

OSTEOLOGY: The holotype possesses 26 presacral, 2 sacral, and 12 caudal vertebrae (5 pygal, 7 complete postpygals anterior to regenerate). Most show breakage at or near the first postpygal vertebra, whereas the most extensive original tail exhibited 13 complete postpygals anterior to the regenerate. The phalangeal formulas of the manus and pes are unreduced: 2-3-4-5-3 manus and 2-3-4-5-4 pes. Premaxillary tooth loci 11–13 (mean = 11.9, SD = 0.9, $n = 23$). Maxillary teeth (unilateral counts) 30–41 (mean = 36.0, SD = 3.0, $n = 22$), dentary teeth (unilateral counts) 38–50 (mean = 43.8, SD = 4.3, $n = 8$). A single pair of crescentic cloacal bones is present in all males and absent in females.

DISTRIBUTION, HABITAT, AND NATURAL HISTORY: The known distribution of this species straddles an ecotone between mid-elevation humid forest and maquis vegetation (O.R.S.T.O.M. 1981). The maquis formation is defined as heath vegetation on ultrabasic rocks and occupies approximately 4500 km^2 in New Caledonia, chiefly in the southern third of the island, but also scattered throughout the central and northern areas. The maquis supports almost 950 species of vascular plants, of which a large percentage are endemic (Morat et al. 1986). The specimens from Mé Adéo were collected at mid-elevation (600 m) in maquis vegetation and from a crack in a roadside cutting passing through adjacent maquis vegetation (AMS R 149953–4) and less frequently at the edge of closed-forest habitat adjacent to the maquis. Specimens from the ranges west of Mé Adéo were obtained from the edge of low closed-forest habitat adjacent to cleared pasture at approximately 500 m elevation. The types were collected in sympatry with *B. sauvagii* and *B. cyclura.* The Mé Adéo locality also yielded a new species of skink of the genus *Lioscincus* (Sadlier et al. 1998).

Two eggs were present in each of 13 female specimens. Although Bauer (1990) reported year-round breeding in *B. cyclura* and *B. sauvagii* based on island-wide samples, the fact that all females of *B. pulchella* were gravid in late October/early November suggests that this species may be a spring breeder. However, multiple clutches are not precluded. Spring breeding is apparently the general trend in many New Caledonian lizards (Sadlier 1986, Bauer and Vindum 1990).

CONSERVATION STATUS: *Bavayia pulchella* is locally abundant at the two sites where it has been collected. Although the sites are near one another, there is moderately extensive maquis habitat more broadly distributed along the axial ranges of southern New Caledonia. It is possible that the distribution of the species is somewhat wider, but extensive collecting elsewhere in these ranges has not revealed additional populations. There are no obvious direct threats to the species other than general habitat degradation, although it appears that the species occupies disturbed habitats as well as more pristine ones.

Comparisons with Other Taxa

The presence of an asymmetrically divided apical scansor on digit I in both *Bavayia exsuccida* and *B. pulchella* differentiates these taxa from *B. sauvagii* and *B. ornata.* Most of the remaining members of the genus (*B. validiclavis*, *B. cyclura*, *B. montana*, and *B.*

crassicollis) may be distinguished from the new taxa by the possession of more than a single row of preanal pores in males. Both differ from *B. septuiclavis*, the only other species with a divided apical scansor and a single row of preanal pores, in their greater number of pores (16–23 in *B. exsuccida* and 18–23 in *B. pulchella* versus 8–14 in *B. septuiclavis*). The two new species are also considerably smaller than all other *Bavayia* except *B. septuiclavis*, *B. validiclavis*, and some forms of the *B. sauvagii* complex. In particular, size, robustness, and a yellow venter clearly segregate *B. cyclura* (maximum 72 mm SVL), *B. montana* (maximum 76 mm SVL), and *B. crassicollis* (maximum 86 mm SVL) from *B. exsuccida* and *B. pulchella.* Both new species share a similar body habitus and a dorsal color pattern characterized by prominent pale dorsal stripes or longitudinal series of pale spots and a "V"-shaped nape marking. Pale striped dorsal patterns occur otherwise in *B. septuiclavis* and *B. validiclavis.* However, in the latter taxon there is a single very broad pale stripe, whereas in the former the vertebral stripe is weakly defined, often appearing only as a lighter base color than the remainder of the body. In neither species is the conspicuous nape marking present. Bauer and Vindum (1990) mentioned a rare color variant in *B. cyclura* in which a dorsal stripe is present, but the details of that pattern differ from those of the new species. *Bavayia exsuccida* differs from *B. pulchella* in its lower number of teeth on all tooth-bearing bones, greater number of midbody scale rows, narrower contact or exclusion of the first supralabial from the nostril, and lack of a vertebral stripe on the posterior part of the trunk.

Phylogenetic relationships among species of *Bavayia* remain obscure. Bauer (1990) found evidence to support the sister-group relationship of *Bavayia* to *Eurydactylodes* + *Rhacodactylus*, but did not perform a species-level analysis of relationships within *Bavayia.* Preliminary allozyme results (A. M. Bauer and D. A. Good, unpubl. data) support the monophyly of the *B. cyclura* group (*B. cyclura*, *B. montana*, *B. crassicollis*) and of the *B. sauvagii* group (*B. sauvagii*, *B. ornata*), but the relationships of *B. validiclavis* and *B. septuiclavis* remain unclear and those of the two new species remain uninvestigated.

DISCUSSION

Along with *Bavayia septuiclavis*, endemic to portions of the southern ultramafic block of New Caledonia, and *B. validiclavis*, restricted to the Massif du Panié and adjacent areas (Sadlier 1989), the new species of *Bavayia* clearly illustrate that this genus, which was once regarded as consisting of only two widespread forms, has had a complex history in New Caledonia. It is probable that cladogenesis within the lineage has tracked geological evolution of New Caledonia itself to yield the patterns of localized endemism observed today. This striking level of intra-island endemism has been noted previously for other endemic lizard genera (Bauer and Sadlier 1993), but the specific areas of apparent endemism occupied by the new taxa are not shared by previously described New Caledonian lizards. *Bavayia exsuccida* is the first vertebrate to be recognized as endemic to the sclerophyll forests of western New Caledonia. It is not known if the species is limited to the Pindaï Peninsula or if it has, or had, a broader range in the sclerophyll vegetation type. Although the fauna of the sclerophyll forests has not been documented in detail, it is likely that the level of invertebrate endemism is high (Bouchet et al. 1995), and recent herpetofaunal surveys have revealed different, if not more, species than had been anticipated (Bauer 1995). Specimens of *Nannoscincus* cf. *greeri* from Pindaï may be referable to a new species and may be similarly restricted in distribution. The total range of *Bavayia pulchella* is unknown, but extensive collecting throughout the New Caledonian mainland suggests that it may be present only in the vicinity of Mé Adéo. Several lizards are endemic to central New Caledonia (Bauer and Sadlier 1993), but only a newly discovered species of *Lioscincus* is apparently restricted to this region inland from Bourail (Sadlier et al. 1998).

Although some of the new taxa being dis-

covered in New Caledonia are cryptic species, diagnosable on the basis of minor scalation differences and molecular characters, others, like *B. exsuccida* and *B. pulchella* and the skinks *Simiscincus aurantiacus* (Sadlier and Bauer 1997*b*) and *Lacertoides pardalis* (Sadlier et al. 1997), are relatively distinctive. The absence of such novelties from existing museum collections is indicative that the discovery and description of endemic lizards from New Caledonia is as much, if not more, a function of prior undersampling as it is of current scrutiny of accumulated collections.

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LITERATURE CITED

BAUER, A. M. 1990. Phylogenetic systematics and biogeography of the Carphodactylini (Reptilia: Gekkonidae). Bonn. Zool. Monogr. 30:1–219.

———. 1995. Geckos of the genus *Rhacodactylus*. Reptiles 3(7): 32–34, 36, 38–42, 44, 46–49.

BAUER, A. M., and R. A. SADLIER. 1993. Systematics, biogeography and conservation of the lizards of New Caledonia. Biodiv. Lett. 1:107–122.

———. 1994. The terrestrial herpetofauna of the Ile des Pins, New Caledonia. Pac. Sci. 48:353–366.

BAUER, A. M., and J. V. VINDUM. 1990. A checklist and key to the herpetofauna of New Caledonia, with remarks on biogeography. Proc. Calif. Acad. Sci. 47:17–45.

BOUCHET, P., T. JAFFRÉ, and J.-M. VEILLON. 1995. Plant extinction in New Caledonia: Protection of sclerophyll forests urgently needed. Biodiv. Conserv. 4:415–428.

JAFFRÉ, T., P. MORAT, and J.-M. VEILLON. 1993. Étude floristique et phytogéographique de la forêt sclérophylle de Nouvelle-Calédonie. Bull. Mus. Natl. Hist. Nat., 4th sér., sect. B (Adansonia) 15:107–147.

MORAT, P., T. JAFFRÉ, J.-M. VEILLON, and H. S. MACKEE. 1986. Affinités floristiques et considérations sur l'origine des maquis miniers de la Nouvelle-Calédonie. Bull. Mus. Natl. Hist. Nat., 4th sér., sect. B (Adansonia) 8:133–182.

O.R.S.T.O.M. (Office de la Recherche Scientifique et Technique Outre-Mer). 1981. Atlas de la Nouvelle-Calédonie et dépendences. Éditions de l'Office de la Recherche Scientifique et Technique Outre-Mer, Paris, France.

SADLIER, R. A. 1986. A review of the scincid lizards of New Caledonia. Rec. Aust. Mus. 39:1–66.

———. 1989. *Bavayia validiclavis* and *Bavayia septuiclavis*, two new species of gekkonid lizard from New Caledonia. Rec. Aust. Mus. 40 [1988]: 365–370.

SADLIER, R. A., and A. M. BAUER. 1997*a*. The terrestrial herpetofauna of the Loyalty Islands. Pac. Sci. 51:76–90.

———. 1997*b*. A new genus and species of lizard (Reptilia: Scincidae) from New Caledonia, Southwest Pacific. Pac. Sci. 51:91–96.

SADLIER, R. A., G. M. SHEA, and A. M. BAUER. 1997. A new genus and species of lizard (Squamata, Scincidae) from New Caledonia, Southwest Pacific. Zool. Neocaledonica, vol. 4. Mem. Mus. Natl. Hist. Nat. Ser. A 171:379–385.

SADLIER, R. A., A. H. WHITAKER, and A. M. BAUER. 1998. *Lioscincus maruia*, a new species of lizard (Reptilia: Scincidae) from New Caledonia, Southwest Pacific. Pac. Sci. 52:334–341.